Designing 'other' citizens into the city:
Investigating perceptions of architectural opportunities for wildlife habitat in the Brisbane CBD.

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ABSTRACT: Traditional perceptions of the human-animal relationship in the urban context typically see the spatial rejection of wildlife from the built environment and limiting of biodiversity conservation programs to areas of natural reserve. As urban growth places further spatial demands on natural habitat and contributes to continued global biodiversity loss, the recently introduced conservation approach of reconciliation ecology makes a call promoting ecological stewardship through embedding wildlife habitat within human dominated areas. Coinciding with this, the architectural sphere has seen a recent trend of design investigation addressing artificial animal habitat as features of the built environment. Although these precedents are currently a niche and scattered trend they show potential to address the human-animal dualism challenging the framework of reconciliation ecology.

This research explores the role design plays in influencing perceptions of urban wildlife habitat, particularly considering the need to create and communicate value around wildlife biodiversity as a component of urban cultural place-making and ecological literacy. The study purpose sets out to establish a set of approaches and cultural preferences with which to direct further classification and development of this architectural trend. Brisbane is utilised as a case study city, as a locale containing proximities of relatively high wildlife and human populations in an urban setting and an established legislative biodiversity heritage and ethic. Through use of a qualitative and quantitative questionnaire targeting Brisbane residents, the research methodology established that although respondents perceptions generally aligned with traditional prejudice against wildlife around human buildings, artificial habitat intervention would be supported within the CBD provided it allowed for adequate distancing of humans from wildlife and conformed with contextual surroundings, or otherwise addressed habitat through redevelopment at an urban scale. As such further research directions for artificial habitat should focus on integration of artificial habitat as a component of façade design or green infrastructure programs.

Keywords: biodiversity, wildlife, habitat, architecture, animals, ecological literacy, reconciliation ecology, public opinion, green infrastructure

INTRODUCTION

> *Others have pondered whether the global loss of biodiversity impoverishes the human species and whether we are creating the conditions for a lonely existence. Hard surfaced urban environments, barren and grey, often feel lonely due to the absence of not only people and active street life but also animals and other non human life. We need these 'others' to complete us, to fend off loneliness.* (Beatley, 2011)

The human-animal relationship is defined by a cultural dichotomy of wilderness and domestication with profound implications for the spatial treatment of wildlife in the urban environment. As human settlement processes have influenced urbanisation as a means of protection from the dangers of the wild, so has tradition in biodiversity conservation focused on 'protecting' wildlife in undisturbed habitat away from human activity (Miller and Hobbs, 2002). However the increasing physical demands placed on habitat fragments and reserves by urban growth are contributing to decrease of global biodiversity at a worryingly high rate; fifty thousand species are estimated to become extinct each year as a result (Hester, 2006).

Reconciliation Ecology, developed through recent work by ecologist Michael Rosenzweig, advocates instead increasing biological diversity within human dominated landscapes through embedding habitat needs of non human species and tools for ecological stewardship within the built environment (Geisler, 2010). Implementing this strategy however faces a challenge in adjusting inherited cultural constructions that define accepted placement and perceptions of 'nature'.

Addressing this in the urban built environment calls for a multi-layered social and functional approach through interdisciplinary collaboration, yet in practice biodiversity and habitat creation remains firmly the concern of ecologists, urban planners and landscape architects (Miller and Hobbs, 2002; Hostetler and Drake, 2009). Although the architectural sphere has seen contemporary examples of investigation into wildlife habitat, notably in the work of architects Fritz Haeg and

Joyce Hwang, these precedents remain as yet a niche and scattered trend. There is at present no comprehensive literature detailing sustainable architectural design methods specifically intended for human-animal cohabitation within the urban realm.

Purpose of the research

Through investigation of the role architecture plays in both providing and influencing perceptions of urban wildlife habitat, the intent of this research is to establish a set of approaches and cultural preferences with which to direct and focus further development of animal habitat as an architectural component of reconciliation ecology.

While the literature review outlines the contextual development and theories that underpin the positioning of the human-animal relationship and motives for biodiversity conservation, the key point emerging for research consideration is the position of architectural design to create and communicate value around wildlife biodiversity as a component of urban cultural place-making and ecological literacy.

Analysis of precedent exemplars identifying a set of categories to describe design approaches for artificial habitat forms the initial methodology approach. In conjunction with concepts developed through the literature review, a quantitative and qualitative questionnaire is used to assess preferences and perceptions for the design direction of artificial habitat within two test sites of a Brisbane CBD based case study area. The questionnaire also addressed respondent perceptions of surrounding wildlife and biodiversity in Brisbane, and their identified potential for change in attitude towards wildlife in response to exposure to artificial habitat.

Case study: Brisbane

The city of Brisbane is situated within range of two of the most ecologically rich 'biodiversity hotspots' in Australia, comprising significant habitat area for a notably high concentration of species including both endemic and endangered wildlife (Commonwealth of Australia, 2009). Despite a 25% increase in population in the last decade, the city still retains a high proportion of natural habitat fragments and permanent nature reserves at 30% of total land cover (Australian Bureau of Statistics, 2012; Brisbane City Council, 2006).

Biodiversity conservation is a recognised priority for the city. Brisbane City Council announced a target of increasing natural habitat area by 10% before 2026 in conjunction with integrating wildlife movement solutions into infrastructure to connect wildlife corridors (Brisbane City Council, 2006). Additionally considerable social value is associated with the 'outdoors' qualities of Brisbane's environmental conditions, and the city actively endorses 'sub-tropical urbanism' as an iconic design characteristic within its built environment (Brisbane Marketing, 2010). Along with natural habitat, the city is making a significant contribution to increasing outdoor amenities and urban forest through an intensive street tree planting and shade structure program (Brisbane City Council, 2006).

These particular situational circumstances – relatively high wildlife and human populations in proximity within an urban setting and a strong legislative biodiversity ethic, together with a recognised design aesthetic that promotes connection with natural settings – establish Brisbane as an ideal locale in which to investigate occupant perceptions regarding accepted expectations of urban wildlife and the potential value of architecture in supporting habitat and developing awareness and understanding of urban biodiversity.

LITERATURE REVIEW

Shifting the theoretical place of nature in the urban context

Modern perspectives defining the urban position of nature owe development to theoretical and ethical foundations laid in the fifteenth and eighteenth centuries. Renaissance humanist philosophy directly encouraged anthropocentric views of building as an "impulse of design... to demonstrate man's power over nature; man's power to order nature" (McHarg, 1998). Particularly in the case of developed nations in the Western cultural sphere, urbanisation as a process has been viewed in terms of 'improving' upon wilderness (Wolch, 2002b).

Architectural critic Sanford Kwinter points to the rapid technological progress and social upheavals of the Industrial Revolution as the point at which design allowed humans to 'emancipate' themselves from the limits environmental conditions. Development of modern cities since has resulted in 'thorough de-naturalisation' of their physical and mental landscapes on a widespread scale (Kwinter, 2010; Wolch, 2007).

Growing awareness of challenges such as fossil fuel dependency, food production, and living quality degradation have demonstrated however that this technological division of urban environment from nature is an abstraction at best. In response the late twentieth century has seen a considerable shift towards bio-centric ecosystem theories. Kwinter identifies two key proponents of this movement: Gaia Hypothesis (1972) and Deep Ecology (1973), both of which attempt to redress the position of man as dominant global authority. The Gaia Hypothesis places the "natural system of the self managing biosphere as morally and theologically distinct from the interests and received purposes of the human species" with Deep Ecology "refusing to see 'nature' or the environment as a mere set of resources to be placed at the service of human purposes" (Kwinter, 2010).

Kwinter (2010) argues the contemporary sustainable design culture that emerged from this shift too often focuses on technological solutions without redressing the human social and cultural factors that enter into ecological thinking. This argument is backed by the

emergence of other theories such as Edward Wilson's Biophilia Hypothesis (1984) which posits that human affiliation or attraction to natural living systems is a genetically inherent instinct developed in consequence of evolution in biologically rich surroundings (Beatley, 2011).

Although the validity of such a genetic link is disputed, several advocates of Biophilia including Randolph Hester, Stephen Kellert and James Miller draw on research evidence suggesting exposure to diverse natural settings and wildlife provides contexts and stimulation that are essential to human cognitive and functional development, well-being, and sense of worldly belonging (Hester, 2006; Kellert, Heerwagen and Mador, 2011; Miller, 2005). Their chief concern is that biophilic affiliation is a weak tendency that can atrophy without the support of cultural learning and experience.

As part of this cultural and theoretical shift, Reconciliation Ecology (2004), comes up against the need to recognise the complex human constraints on ecological design. If nature, including wildlife, is to be repositioned into an equitable partnership with humans then urban design must provide tools for effective education in managing obligations towards this partnership.

The boundaries of the human-animal relationship

The distinct problem facing urban wildlife is that the human-animal relationship is rarely viewed in terms of a partnership. The 'right' of animals to occupy 'human' urban places, and criteria by which we admit or reject them are constantly re-evaluated on an individual basis through subjective judgements of an animal as a non-human 'other' and its position within the wild/domesticated praxis. Human willingness to share space with a wildlife presence is strongly linked the origins of architecture as protective shelter and concepts of property (Ingraham 2006; Wolch 2002a, 2002b).

The perception of animals as a form of 'property' informs the primary mode of positive co-habitation in urban space, often in the role of pets. In the case of 'unowned' wildlife, humans are more likely to encourage occupancy if the animal can be anthro-pomorphised as a form of social property with which they can share identity: either as part of the cultural majority as a 'native' animal in its 'home' environment, or cultural minority as a 'wild' animal seeking 'refuge' from the urban threat (Wolch, 2002a).

There are pragmatic concerns for property at play too; a study conducted by the NSW Parks and Wildlife Service (2002) found that home-owners would encourage wildlife if they felt the animal could add positive value to their property or well being. Other research has indicated such a correlation between species diversity and socio-economic status; species diversity in urban residential areas is shown to increase with economic status (Alvey, 2006). The views in the NSW study were strongly linked to the perception of the animal as having a 'good reputation'; home-owners distanced themselves from wildlife that was seen to be unsuited to urban space and residential gardens (N.S.W. National Parks and Wildlife Service, 2002).

An opposing perception of animals as sentient beings in their own right has mixed implications for the valuation of wildlife. Following from the lead set by Gaia Hypothesis and Deep Ecology, the seminal 1975 text *Animal Liberation* by Peter Singer argues against human bias towards animals or 'species-ism', charging humans with a moral responsibility towards “equal consideration of the interests” of animals (Fox, 1978). The growth of the animals rights movement since then has posed the possibility to grant animals legal 'non-person hood' status and potentially confer wildlife with genuine rights and considerations as stakeholders in the urban planning and design process. Primary criticism against this argues that such moral rights cannot be granted to wildlife on the basis of their limited capacity for “mutual accountability and reasoning”, drawn from an ingrained fear of the unpredictability of the wild and its potential to harm (Ingraham, 2006).

Negative valuation of wildlife is thus linked with animal potential to “destabilise the security of the domestic environment” (Campkin, 2012). Species with such undesirable connotations are labelled as 'pests' and felt to be 'invasive' of human occupied space. Disgust, fear of situational conflict and concerns over property damage being the primary emotive factors for individuals. Injuries through scratches, bites and swooping; disease transmission; irritating noise; fouling through animal waste; material damage to buildings and gardens form the basis of most complaints (Temby, 2004; Bjerke and Ostdahl, 2004). Respondents to the NSW Parks and Wildlife Service indicated along this theme that they preferred animals seen to “take care of themselves” and favoured wildlife occupation in areas away from direct contact with humans and human property (N.S.W. National Parks and Wildlife Service, 2002).

Apparent in the literature then is while individual opinions may be conditional, the dominant paradigm of the human-animal relationship in the urban context perceives wildlife as best restricted to 'wilderness'; the built environment as the realm of human control must first and foremost serve human needs. Linked back to the concept of architecture as a property boundary, many people tend to view buildings and gardens as distinctly bounded spaces with limited influence on the wider surrounding ecosystem. As such there is a widespread trend for individuals to mentally partition their activities in urban space as separate from natural environment, contributing to belief that habitat quality as an environmental issue exists beyond the immediate neighbourhood (National Parks and Wildlife Service, 2002; Clayton, 2007).

Developing urban ecological literacy

For urban wildlife, the complications that arise from this distancing of perceived 'best' habitat and 'wilderness' are manifold. A 'presumed unimportance' of biodiversity in urban planning and design is a not just a functional problem of conflicting spatial needs for housing and infrastructure over habitat, but a social issue created through an 'extinction of experience' fostering gradual isolation from nature and understanding of natural processes. Miller argues urban areas are subject to the complications of 'environmental generational amnesia' whereby knowledge, valuation and expectations of ecological qualities attenuate with each successive generation (Miller, 2005).

According to Robert Dunn et al. (2006) this decline impacts not just wildlife populations within urban areas but spreads to those remaining in protected reserves. While city occupants display relatively limited rates of interaction with local wildlife and the natural world, their perceptions and knowledge of biodiversity formed within the scope of these often mundane urban experiences inform popular and political values that contribute most to supporting meaningful conservation efforts outside cities (Dearborn and Kark, 2009).

Therefore urban residents must see wildlife as relevant to their present context in order to value its protection elsewhere. The 'perceptible realm' in which humans engage with environmental and ecological phenomena is directly related to interpretation of its expression in the forms, scales and systems of their immediate surroundings (Gobster et al., 2007). Hester (2006) terms this as 'inhabiting science' or the development of urban ecological literacy; designing ecological processes to be a tangible, involving and positive part of everyday experience through which understanding and comparisons of place can be built. For Hester, building mental connections between a place and its functioning is critical to making decisions about appropriate habitation of that place, and in the case of urban wildlife – appropriate co-habitation.

Constituting the prevalent contexts of human existence — residences, workplaces, streets — buildings are often the most dominant and visible components of the perceptible urban realm. As such architecture presents significant opportunities for *inhabiting science;* rather than being represented in conflict with habitat, the opportunity exists to re-evaluate the role architecture plays in defining habitat. In order to develop opportunities for positive engagement with wildlife, Reconciliation Ecology requires this must occur as an accepted part of human occupancy, not in spite of it.

Biodiversity: perceiving value at community level

Australia's current National Strategy for Biodiversity partially addresses this 'everyday value' of species conservation; the government document recommends broad spectrum citizen engagement in *mainstreaming biodiversity,* with an interim target to reach a 25% increase in the number of citizens and organisations who participate in biodiversity conservation activities by 2015 (Commonwealth of Australia 2010). The strategy however indicates principle areas for implementation of environmental stewardship and biodiversity management are focused on market and partnership incentives with private concerns in primary industries, whom effectively manage 60% of Australian landmass (Commonwealth of Australia 2010).

This suggests opportunities publicly promoting biodiversity conservation and environmental stewardship across more diverse urban demographic groups are being under-utilised. The NSW Parks and Wildlife Services study partly substantiates this idea, finding there was a distinct perception amongst individuals that local council and wildlife groups were most responsible for enacting biodiversity measures as respondents “feel there is not a great deal they can do personally to have a positive impact on wildlife conservation” and rated it as a low sustainability concern (N.S.W. National Parks and Wildlife Service, 2002).

A comprehensive study by Donald Dearborn and Salit Kark (2009) documenting motivations influencing urban biodiversity policy determined that in fact many conservation projects were driven by foremost by community needs. These included:

- Improving the presence and quantity of green open space, highly valued by communities, with the benefit of connecting habitat patches to strengthen biodiversity over the whole of a landscape matrix
- Secondary benefits of environmental education such related opportunities for tourism, recreation and modes of active community involvement such as citizen science.
- Provision of beneficial ecosystem services such as pollination for agriculture, which often have complex interrelated functions.
- Fulfilling ethical responsibilities and community obligations for stewardship advocated by varied philosophical, religious and secular traditions.

In their findings Dearborn and Kark (2009) conclude that although community projects are successful at initiating conservation efforts, the outcome may either require substantial ecological compromises or alternatively, a clearly identified priority and targeted demographic in order to satisfy the demands and individual needs of various cultural and social stakeholder groups involved.

To this end Hester (2006) discusses the importance of thinking 'outside the lines' of site boundaries and pre-determined stakeholder programs; instead drawing 'bigger picture' opportunities from across the whole city-environment matrix to supplement the brief. Hester argues genuine creative problem solving occurs through “connecting things that that obviously do not go together” – in the context of this paper buildings and

wildlife – and leading the community to find value in things that would otherwise remain unfamiliar, unaccepted or out of focus.

Humans vs. wildlife as client and content

Designing wildlife habitat within the urban built environment is therefore as reliant on community place-making and aesthetic design language to form value around the habitat and the occupying animal as well as the functional performance of the habitat itself. Forming a positive emotional connection in particular is critical in developing the sense of ownership and mutual obligation that drives environmental stewardship (Derbyshire, 2011; Hester, 2006). There are contending streams of thought regarding the appropriate balance to achieve this, evident in the dispersed approaches of precedents within the artificial habitat design trend.

Eco-revelatory design, a mode originating in the field of landscape architecture in the 1990's, is in practice concerned with using design language to 'reveal' the presence of ecological phenomena within a place, (Eisentein, 2001), for example demonstrating an open water cycle through bio-swales and retention ponds, or the interrelationship between insect growth and leaf decay cycles in an insect hotel (Figure 1). Healthy ecological processes do not always correlate with visually pleasurable design aesthetics however, meaning that the subjective influence of the designer may sway occupant perceptions on what constitutes 'good' or quality environmental design and its value to the public realm (Gobster et al., 2007).

Anna Jorgenson and Lilli Licka (2012) argue against using specific design intent, advocating for urban wildscapes instead. They propose symbolic expression oversimplifies experience and limits development of an enriched understanding of place through the act of noticing and making connections for one's self. Wildscapes are defined as “spaces between or on the margins of more programmed and controlled urban spaces”, and operate on the concept that environmental development, phenomena and meaning cannot be prescribed (Jorgensen and Licka, 2012). Such spaces form independently through successive unique and unintentional actions by unrelated citizens and spontaneous environmental processes (Figure 2). Although negative connotations such as disorder, decay and insecurity are often associated with wildscapes, they provide a necessary service for ecological literacy in demonstrating that fundamental environmental processes exist beyond the scale of human order (Dunn et al., 2006; Jorgensen and Licka, 2012).

In contrast to the ecologically focused qualities of the preceding approaches, the majority of the precedents within the architectural design trend draw from the human-animal theoretical divide and focus on using an intentionally man-made aesthetic design language to expose the obvious 'unnaturalness' of animal habitat within a built environment (Figure 3). Key figures within this area cross between disciplines of art, activism and architecture, promoting awareness of nature and biodiversity through the impact of visual, conceptual and cultural juxtaposition. They promote the idea that artificial habitat intensifies the unique possibilities and character of urban ecosystems in configuring new modes of interaction and habitation; a chance to “complicate the neat boundaries of the animal-architecture dialectic” (Campkin 2012).

Figure 1: Eco-revelatory insect hotel (Cooper, 2010)

Figure 2:Wildscape insect hotel (Silver Tiger, 2012)

Figure 3: Expressive insect hotel (ARUP, 2010)

Figure 4: Fritz Haeg – Snag Tower, artificial habitat designed to accommodate seven species types (Austin, 2011)

Figure 5: DAAR – Return to Nature project (DAAR, 2009)

Figure 6: Joyce Hwang – Bat Tower (Hwang, 2012)

The work of architect and artist Fritz Haeg in particular is centred in his positioning wildlife as the architectural 'client' rather than human. His ongoing *Animal Estates* project (2008 – present) specifically focuses on translating the requirements and habitat characteristics of a species native to an area into structures, installations, collaborative projects and accompanying 'field guides'. These projects encourage physical and cultural reinsertion of the presence of the species into the built environment which has excluded them and physically place their spatial needs as equivalent in status within the urban environment as the human buildings along side (Figure 4).

The hypothetical *Return to Nature p*roject (2009) by Decolonising Architecture Art Residency (DAAR) instead investigates wildlife as unintentional clients, and places them within the political context of colonisation.

> *The acceptable precondition for planning is a situation of spatial and political certainty – a clear site demarcation, a schedule, a client and a budget The erratic nature of Israeli control and the unpredictable military and political developments on the ground renders Palestine an environment of high uncertainty and indeterminacy* (DAAR, 2009).

The project (Figure 5) proposes preventing Israeli takeover of a de-commissioned Palestinian military base by placing architectural destruction and disorder as the point for spontaneous colonisation of by migratory birds, returning an architectural wildscape to wilderness.

With her experiments involving habitat for bats, *Bat Tower* (2010) and *Pest Wall* (Work in progress) architect Joyce Hwang takes the approach of design as a methodology to “tackle seemingly mundane problems” with “poignancy” (Dodington, 2011), and exploring the role of architecture as vehicle for mediation and awareness. Positioning the Bat Tower (Figure 6) as a deliberately aesthetic structure within the context of a sculpture park, challenges the notion that bats are considered an urban pest of low status. Hwang particularly stresses the promoting awareness of the critical pest insect control function bats provide themselves in the urban ecosystem by incorporating insect attracting vegetation as part of the design.

Existing conditions of urban habitat

Beyond considerations of the aesthetic, determining the practical requirements for artificial habitat requires thorough understanding of urban habitat as it currently functions. Despite assumptions that cities are a watered down version of nature, research is revealing urban areas such as Brisbane contain comparably unique levels of native and non-native biodiversity. Paramount value will always be placed on the role of undisturbed land and natural reserves in biodiversity conservation, however urban ecosystems are slowly being acknowledged for the insight they provide into evolutionary interrelationships between wildlife and human activity (Alvey 2006; Szlavecz, Warren and Pickett 2011; Savard, Clergeau and Mennechez 2000).

Urban habitats are broadly described as being either artificial (the complete result of urban development and intervention) or semi-natural (still retaining a measure of original habitat). Architectural contribution to wildlife habitat thus far lies mostly in animal adaptation to shelter and nesting opportunities found in structures. Such artificial habitats provide biotope requirements through intentionally specific construction, or as 'accidental analogues' whereby part of a building

incidentally replicates natural features e.g. a sheer building façade that mimics a cliff face for roosting birds (Wheater, 1999).

Urban species composition is loosely determined by the size and capability of fragmented original habitats to continue supporting dependent populations, or alternately species ability to utilise changed habitat conditions such as building analogues and gardens. Wildlife is categorised as either an urban avoider, adapter or exploiter (Table 1) (Roetman 2008):

Table 1: Urban wildlife types (Author, 2012)

Classification	Habitat Range	Characteristics
Avoider	Undisturbed land or nature reserves. Large territory range.	Large/predator species. Discouraged by humans or cannot tolerate fragmented habitat.
Adapter	More prevalent in undisturbed land. Urban fringe. Small or shifting territory ranges.	Small to medium species. Often native. Can take advantage of human food and shelter sources.
Exploiter	Populations more common or only found in urban areas. Transient ranges.	Often introduced species. Some dependency on human food and shelter sources.

Urban exploiters are of particular interest in the built environment as they indicate rates of synanthropisation (adaptation to human-created conditions) and specifically synurbisation (adaptations to landscape changes made through urban development) (Luniak, 2004). Urban exploiters often form the basis for 'invasive' pest populations such as spiders, cockroaches and mice as these species are the most likely to use building interiors as well as exteriors for habitat (Wheater, 1999). However comparably 'desirable' species known to inhabit structures include birds, bats, and bees. Due to their relative visibility, migration activity and sensitivity to habitat changes, these species are a highly critical component to ecological literacy as indicator species measuring functional health and quality in local ecosystems.

Design considerations for artificial habitat

Successful integration of artificial habitat into the urban environment is dependent on clarifying a species strategy prior to design development, in which the following should be identified (Savard, Clergeau and Mennechez, 2000):

- The desired target species (or species) and their physical requirements.
- The intended extent of the habitat. Is the habitat required to support an existing population, maximise its presence or introduce/re-introduce a species?
- Will the population require human monitoring and management?
- Intended level of human contact, interaction or intervention e.g. observation only, web cam monitoring.
- Strategies against habitat invasion or competition by undesirable or predator species.
- Potential flow-on issues from the habitat that may effect the surroundings and vice-versa.

Table 2: Artificial habitat considerations (Author, 2012)

Design Parameter	Requirements
Dimensions	Spatial needs per species size and number. Integration with standardised building components.
Proximity	Food and water sources. Materials sources for nest building, e.g. mud, sticks.
Positioning and Adjacency	Habitat exposure: height, visibility, wind and thermal exposure etc. Windows, open areas and building access points relative to habitat: avoid situational conflict with human occupants and neighbouring buildings.
Access	Target species able to find access points. Non-target or predator species discouraged. Human access for monitoring, management and maintenance.
Materials	Potential for building damage: select appropriate and durable materials. Soundproofing and noise mitigation. Bird friendly façades.
Lighting	Wildlife friendly lighting schemes, particularly for nocturnal species.
Permeability	Does the species prefer enclosed spaces? Management of animal waste and fouling.

Close building proximities in urban environments necessitate careful consideration of potential impacts beyond the immediate habitat boundary, especially with regards to managing population numbers, territory and movement activity. A recognised architectural issue in cities is bird deaths from aerial collisions; habitats targeting birds should ideally be supported in the surrounding areas through bird friendly measures such as non-reflective or patterned glass in façades, lighting schemes with limited aerial spill, and careful positioning of vegetation relative to buildings (Sheppard 2011). Alternatively, surrounding buildings may choose to employ anti-bird measures to prevent roosting and fouling of their façades, particularly heritage buildings.

As such incorporating artificial habitat design as part of a reconciliation ecology approach in urban areas should place a priority on provide solutions that appeal

to property owners in mitigating specific site conflicts between human and wildlife interests.

Summary of key concepts

In using architecture as a vehicle for embedding wildlife habitat into the built environment, reconciliation ecology as a strategy for biodiversity conservation must primarily address ingrained human perceptions driving compartmentalisation and distancing of 'wild' nature in urban areas. The primary construct driving this is tradition in posturing buildings as human only properties, intended to protect from nature and wildlife as an 'other' entity whose behaviour can be enjoyed but not prescribed or predicted.

Thus although the importance of increasing wildlife and biodiversity is recognised, its support within the perceived boundaries of human domains will be subject to awareness of its identified value relative to the individual and community. Developing such awareness in the form of promoting ecological literacy, is key to positively influencing the valuation process. This requires careful consideration of intended human audience and function beyond the needs of the biodiversity target when incorporating habitat, in particular the relative positioning of artificial habitat on the culturally enforced scale between natural and man-made. What does placing artificial habitat within the realm of architecture hope to achieve both culturally and environmentally, and what precise value is it intended that humans should derive from such an approach?

RESEARCH OBJECTIVES

The literature review demonstrates a detailed understanding of social and cultural expectations is critical to successful synthesis of urban and ecological design. Therefore the aim of the research was to collating such information in order to provide a basis for determining the suitability of architectural habitat as an innovative strategy within the case study area and it's applicability to relevant design and policy guidelines.

Addressing the research aim required investigation of the following objectives:

- Identify key themes in user perceptions regarding their relationship, valuation and day to day interaction with urban wildlife within the existing public realm conditions.
- Identify where established perceptions on key theoretical concepts underpinning wildlife position in the built environment such as the distancing of human/animal environments remained apparent in the case study area.
- Identification of key trend categories for the design direction of artificial wildlife habitat within the architectural realm.
- Assess user preferences between the main category trends for integration of potential architectural based habitats within the urban public realm in Brisbane.
- Assess user concerns and support for such architectural based habitats.
- Assess user identified potential for change in their relationship, value and awareness of urban wildlife and biodiversity conservation issues in response to architectural based habitat intervention.

METHODOLOGY

Background

The first phase of research involved examination and comparison of 20 precedent exemplars of architecturally based artificial habitat collated during the process of literature review. This analysis process determined general consistencies in physical design approaches in order to determine and establish specific categories that are emerging within the field of the trend.

The second phase utilised the categories designated in the first phase, together with themes and concepts developed in the literature review to structure a medium length questionnaire for dissemination amongst a sample group of Brisbane residents. This questionnaire gathered quantitative and qualitative data on respondents' perceptions and attitudes towards artificial habitat providing indication of preferences in design direction and evaluation of potential performance on factors such as ecological literacy and biodiversity awareness.

Precedent exemplars

Due to the dispersed and innovative nature of precedents in the field of study and limitations on available literature, the precedent review included both built and hypothetical projects. To provide a comprehensive overview of variations within the trend, a diversity of species and habitat typologies was taken into account. As the intended use point was for unowned urban wildlife in the public realm, artificial habitat for the purpose of containment or exhibition such as zoo habitat, was not considered.

All data on precedents, (refer Appendix A), was collected from primary sources, including professional and academic print works and web based resources. Data collection was primarily image based, however care was taken to include design statements, documentation and related media where possible.

Data for each habitat project was analysed under the following headings:

- Project overview
- Design intent and aesthetics
- Target species
- Dimensions
- Positioning within built environment
- Adjacency to human occupied areas
- Access
- Materials

Participants and procedure

The target demographic for the questionnaire sample group was Brisbane residents who visited the CBD area on a regular or semi-regular basis and thus would have familiarity with the case study test areas in order for contextual consistency across the results. Participation in the research was anonymous and entirely voluntary. No restrictions were placed on age, sex, gender or education when recruiting participants in order to increase the diversity of the sample group.

A request for participants was advertised online: 25 people contacted the author and were sent the questionnaire to complete as a form through private email. Of these 25, 16 people returned the completed questionnaire, a response rate of 64%. Of these participants, 10 were male, 6 female. All participants identified within a 19-44 age bracket. All participants had at least a university degree level education with 6 holding post graduate degrees.

Questionnaire structure

As an initial study, the questionnaire (refer Appendix B) was designed to get a broad overview of themes in respondent perceptions and attitudes. The questionnaire contained 23 items structured in three sections under the headings Living with Wildlife, Wildlife in the Brisbane CDB and Response to Artificial Habitat. An additional section gathered participant background data as detailed above.

The first section assessed attitudes towards being around wildlife, wildlife literacy, and support of biodiversity conservation. This section used quantitative items where participants could select either a yes/no or a scale answer e.g. Strongly like, like, neutral, dislike, strongly dislike. A short answer qualitative was included asking participants to describe their perceptions on the role of the built environment for human and wildlife occupation.

The second section included a more discursive style quantitative and qualitative items directing participants to think about existing wildlife in the city and the biodiversity richness of Brisbane. The main focus of this section was to introduce participants to the identified categories of design approach for artificial habitat in the built environment. This section then asked them to indicate multiple preferences for hypothetical inclusion of artificial habitat into two locations within the case study area. Preferences were assessed separately in the following categories:

- Species
- Type of habitat
- Positioning of habitat

At the end of each test area section, space was given to the participant to explain the reasoning for their preferences, allowing for more expansive in-depth qualitative data in directing further research of design opportunities.

The final section returned to the quantitative format with yes/no/not sure answers and was direct about assessing users self-identified response to seeing such types of artificial habitat. The intent of this section was to identify whether artificial wildlife habitat would be perceived to have a measurable impact on areas such as wildlife ecological literacy and biodiversity awareness.

Case study area

The case study area for the two test sites assessed in the research was Albert St in the Brisbane CBD. Albert Street is an easily accessible and central street within the CBD that intersects with the main pedestrian retail precinct Queen Street Mall and would be known to the questionnaire demographic.

Albert Street transects between the two main parkland areas of the CBD, Roma Street Parklands and the Botanic Gardens, while also containing a variety of urban building and street typologies across heritage, and mid to high rise residential and commercial. As such Albert Street represents a variety of potential areas for architectural integration of wildlife habitat within range of significant natural habitat areas, and within visual range of significant areas of human public realm.

Figure 7: Queen St. Mall, within case study area (Brisbane Marketing, 2011)

RESULTS AND DISCUSSION

Identified Architectural Artificial Habitat Categories

Review of available precedent exemplars associated with the recent architectural trend identified four consistent general themes for design approach and integration of artificial habitat into the built environment.

- Self-contained
- Inserted
- Envelope
- Green infrastructure.

A habitat project is not necessarily limited to one approach how-ever, for example numerous inserted habitat across a façade may function as an envelope habitat, or an area functioning as green infrastructure may contain a structure of free-standing habitat. The four categories are detailed in the following:

1) *Self-contained habitat*

Spaces intended for wildlife occupation are evident as independent constructions, either as free-standing assemblies or as external building attachments. Often they are visibly differentiated in materials or aesthetics from the host structure or landscape. This approach allows ease of relocation or modification as needs arise. Common exemplars include artificial nesting boxes, bee hives, lizard slabs, roosting platforms and feeding structures.

2) *Inserted habitat*

Inserted habitats display similar elements to self-contained habitats, excepting that the habitat space is physically integrated into the building as distinct component. Although availability and range is currently limited, pre-fabricated modular construction elements providing habitat are growing in popularity, particularly for bird nesting activity. Alternatively, more complex bespoke solutions may be required, e.g. access and accommodation for bats roosting in large ceiling cavities.

3) *Envelope habitat*

Wildlife habitat features are created through integrated design elements across a façade or surface, so that the primary identification is a whole building. Envelope habitats often arise through incidental analogue design e.g. green walls encouraging foraging, or ornamentation that function as perches. Intentional incorporation allows for creative design solutions. Envelope habitats may encourage transient wildlife rather than permanent occupation or nesting activity.

4) *Green infrastructure*

Green infrastructure has significant crossovers between architecture, landscape and urban design. Green infrastructure is intended towards adequate provision of urban ecosystem services and is often concentrated in streets/movement corridors or coupled with recreational areas. As such it may contain a high degree of man-made structures and hard-scape elements. Green infrastructure serves a primary function for urban wildlife in habitat connectivity and foraging and is often coupled with storm water, soil and air quality management processes. Green infrastructure is a good candidate for either revelatory or wildscape aesthetic approaches.

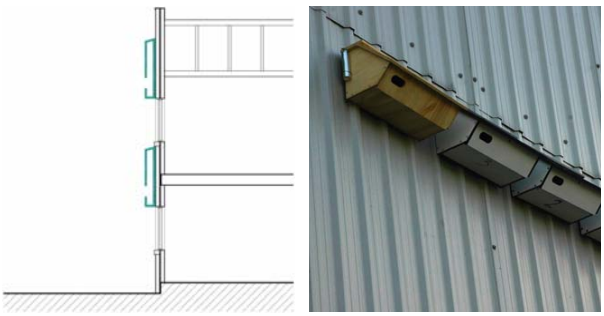

Figure 8: Self-contained habitat (Author, 2012; Filcris Ltd., 2011)

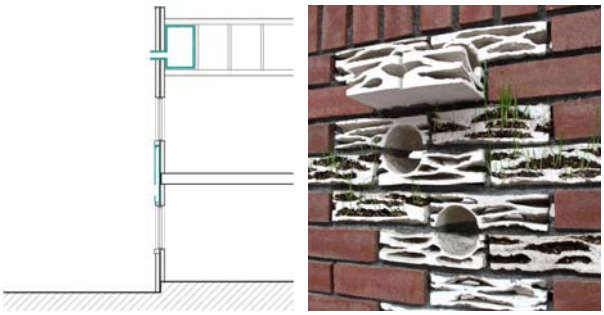

Figure 9: Inserted habitat (Author, 2012; Fabrikaat, 2012*)*

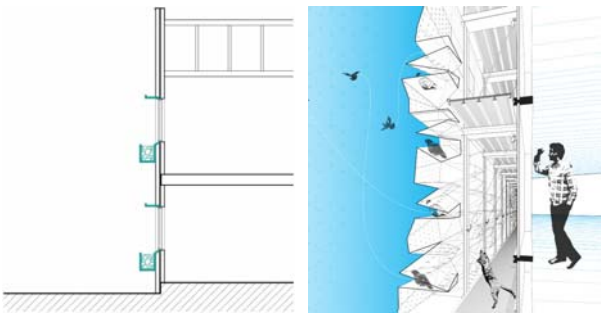

Figure 10: Envelope habitat (Author, 2012; Lamphier, 2011*)*

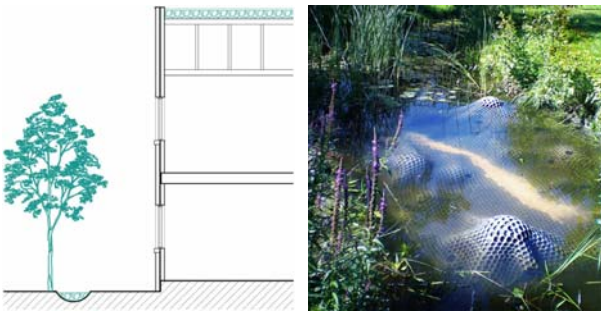

Figure 11: Green infrastructure (Author, 2012; Vision Division, 2010*)*

Existing wildlife experience in the case study area

Before rating preferences for design intervention in the case study area, participants were asked describe previous experiences of wildlife observation within that location. In line with relative expectations for an inner city urban area with a high density of buildings, traffic and human occupants, participants generally reported low incidents of direct wildlife encounters (Table 3).

Usage patterns in the area by the participants may play a contributive role. The majority of participants visit the CBD area once a week or less (Table 3), indicating opportunities for consistently coming across wildlife in that particular setting would be limited. Similarly within the built areas of the case study location, the nature of the most popular activities indicated (Table 3) – socialising, recreation and retail – would likely preclude intentional or expected interaction with wildlife and reduce conscious observation activity.

Table 3: Wildlife observation and participant usage patterns in the case study area (Author, 2012)

Response	Percentage (%)
Have you specifically noticed wildlife around when you have been in this area of Brisbane CBD?	
Frequently	6.25
Occasionally	25.00
Sometimes	25.00
Rarely	37.50
Never	0
Frequency coming into the CBD	
Once a month or less	31.25
Once a fortnight	25.00
Once a week	18.75
2-4 times a week	12.50
5 or more times a week	12.50
Reasons for coming into the CBD	
Place of residence	2.40
Place of work or work duties	4.80
Place of education	0
Social activities	38.00
Leisure or recreation	28.60
Retail	26.20

Figure 12: Case study area – Albert St, Brisbane CBD (Author, 2012)

The high frequency of responses reporting wildlife in park areas bordering the case study area (Table 4) partially substantiates the assumption vegetated urban areas support a higher population and variety of wildlife than the case study area itself, as iterated by one participant:

> *Mostly I watch birds and lizards while sitting in the Botanic Gardens, otherwise its rare to see wildlife in the CBD.*

In the same manner there is the underlying concept that participants may be more likely to expect or intentionally look for and associate wildlife within the more naturalised setting. As an example of specific context and expectation, few participants referred to watching ducks in the garden ponds. Most experiences reported were however incidental and neutral in manner, occurring while the participant was moving through an area.

Table 4: Thematic frequency in wildlife observation responses (across 16 responses to open ended question) (Author, 2012)

Response theme	Count	Example
Species		
Birds	31	"I've primarily noticed bird life"
Lizards	4	"Lizards litter the walkways"
Possums	3	"On occasions I've noticed possums"
Area		
Botanic Gardens	11	"Lots of birds in the Gardens"
Roma St Park lands	7	"A lizard near Roma St Park lands"
Queen St Mall	4	"Pigeons roaming around Queen St. Mall"
Albert Street	2	"Watching Noisy Miner Birds fly along Albert Street"
King George Square	2	"Ibis scrounging food around King George Square"
Experiences		
Animal foraging or near rubbish	6	"Birds eating food on the ground" "I only see Ibis scrounging in rubbish"
Observing/watching	5	"Observing ducks in the Botanic Gardens"
Listening	1	"Listening to birds whilst walking through the Gardens"

Bird life was the vastly predominant in responses (Table 4), either referred to in general or individual species named; the most frequently mentioned were pigeons, ibis and ducks. While bird observation in the case study area was generally described as a positive experience, pigeons and ibis were associated with high incidences of negative interactions such as disturbing rubbish and stealing food as described by one participant:

> *I only see Ibis scrounging in rubbish bins. I don't think pigeons count as wildlife, so only Ibis. It's a big negative – the Ibis shouldn't be eating our rubbish, it's*

not healthy and we shouldn't be making it easy for them to eat our rubbish.

This indicates a strong awareness of urban exploiter prevalence amongst Brisbane's visible urban wildlife and their reputation as pest animals, confirming participant experiences and perceptions of disgust and fear of animals were in line with concepts established in the literature review. Despite these concerns recurring throughout the questionnaire, the majority of participants indicated a strongly positive attitude towards wildlife and felt an increased presence of wildlife would improve their overall experience of the CBD (Table 5).

Table 5: Contribution of wildlife to CBD experience (Author, 2012)

Response	Percentage (%)
Would seeing more wildlife present around public places make being in Brisbane's CBD a more engaging experience?	
Yes	75.00
No	6.25
Unsure	18.75

Preferences for artificial habitat design intervention

Participants were asked to rate their preferences regarding design intervention approach for artificial habitat in two locations within the case study area. Site A (Figure 13) representing a major pedestrian area with significant exposure; Site B (Figure 14) a typical mixed traffic street with varied levels exposure.

Figure 13: Site A – Albert St adjacent to Queen St Mall (Author, 2012)

Figure 14: Site B – Albert St between Charlotte and Mary St (Author, 2012)

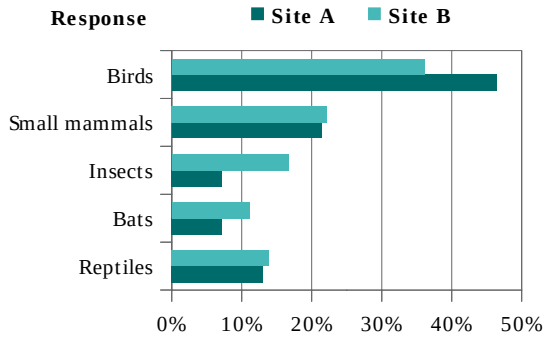

Figure 15: Species preferences as percentage of responses (Author, 2012)

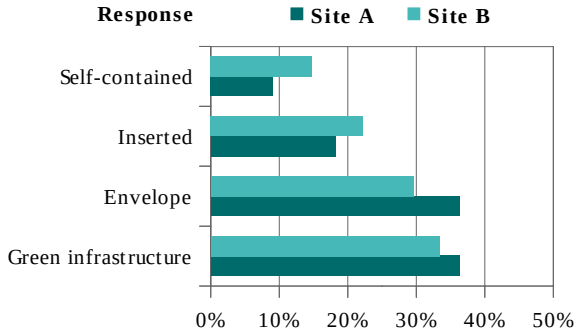

Figure 16: Habitat design typology preferences as percentage of responses (Author, 2012)

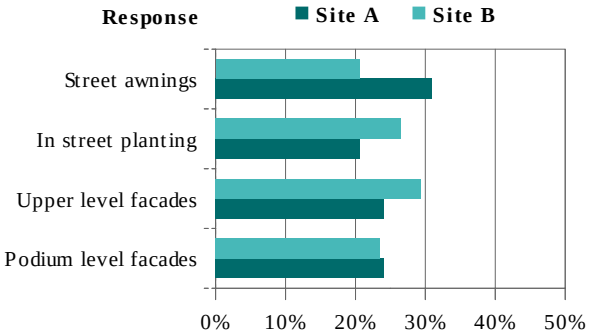

Figure 17: Habitat placement preferences as percentage of responses (Author, 2012)

A significant majority of participants identified bird life as their preferred target species for the design of artificial habitats in both locations (Figure 15). Although participants could indicate more than one species type, several participants chose only birds (8 of 16 responses for Site A, 5 of 16 responses for Site B). Species suitability for occupation and co-habitation was an important theme in open ended responses across both locations (Table 6, Table 7). Within the responses, it was often coupled with ideas relating to protection of wildlife and the degree of interaction between humans and the habitat. Ground dwelling species were seen to be at risk from human pedestrian disturbance within Site A and the significant traffic risk in Site B.

Birds present as a more practical species as they “can fly and have the option to escape”. Carrying over from the questioning over existing experience with wildlife in the CBD, bird presence in the area was already seen as an acceptable expectation, as such there was an indication birds were seen to have the highest probability of success as an appropriate habitat directive. As bird species variety represents a significant sector of Brisbane's biodiversity heritage, this does present a potentially achievable conservation approach. The following response is representative of this targeting:

> *I have chosen to accommodate for the bird life already in the area as well as to encourage more to the area. For this to happen, envelope habitat could occur at higher levels with different types for different birds. The pattern of use for the area is high human use and occupation so smaller mammals, reptiles and insects would not be welcome in such a place at street level.*

Alternatively, some participants stressed a multi species, multi habitat type approach although none gave explanation for their specific choice of species combinations; reasoning was based around either providing a broad spectrum approach – “If there are lots of opportunities one of them is bound to work” – or using habitat as a form of urban redevelopment, as implied by the following participant:

> *I think an integration of ground, awning and upper façade development would be the most visually pleasing and powerful technique to introduce wildlife to the CBD. Make the ground level interesting for personal interaction, an awning level like the arbour for shading and greenery, and renovate the upper level façades for bird boxes etc.*

In this vein many participants heavily affiliated with green infrastructure (Figure 16) as the preferred design typology on basis of its potential to provide further benefits with human based value; shading, views and beautification through greening, and air quality were most commonly identified. An approach with multiple sustainable urban strategies targeting human systems could be determined as the most appropriate way of encouraging acceptance, with habitat inserted as a second phase initiative. This echoes Hester's argument for targeting a 'bigger picture' positive emotional and functional connection, although negates the idea of using habitat as a 'thinking outside the box' attention grabbing method, with a participant warning against such habitat being a novelty only.

This preference against habitat with high visual impact such as advocated by Hwang and Haeg was evident across multiple responses. Several descriptors such as “discreet”, “subtle”, “not so noticeable” were used (Table 6, Table 7). While there was some acknowledgement building façades could provide a good level of exposure and visibility, the second most prevalent choice of design typology – envelope façades (Figure 16) – was strongly correlated instead with concerns for distancing and separation of habitat from

Table 6: Thematic frequency regarding habitat preferences in Test Site A (across 16 responses to open ended question) (Author, 2012)

Response theme	Count	Example
Site A – Albert St adjacent to Queen St Mall		
Separation/distance	6	“Keeping enough distance between a busy pedestrian zone and wildlife”
Aesthetics/visibility	5	“The podium level would give an adequate separation while maintaining a strong visual connection”
Species suitability	5	“Attempts to encourage wildlife at street planting levels would be wasted, especially with more 'shy' fauna”
Functionality of space	3	“Envelope habitat at podium level appears as it would be the most functionally successful”
City-wide value	3	“Green infrastructure is important for humans, so incorporate that to help provide clean air, view etc.”
Human activity	3	“Queen St Mall has a lot of foot traffic and people sitting around”
Protection / danger to wildlife	3	“People might attempt to tease or harass animals”
Species variety	3	“I think it is important to have a range of structures to allow for the different needs of different species”
Discretion	2	“I think, initially, people would be more accepting if these habitats didn't stand out too much”
Close interaction	2	“Artificial habitats are better located close to street level where people can interact with it”

Table 7: Thematic frequency regarding habitat preferences in Test Site B (across 16 responses to open ended question) (Author, 2012)

Response theme	Count	Example
Site B – Albert St between Charlotte and Mary St		
Protection / danger to wildlife	7	“Ground dwelling animals present a point of conflict as they may be harmed by passing cars”
Species suitability	5	“Bats would not fit in this area because of their reputation as scary/dirty animals”
Functionality of space	4	“Building up around the planting already there would allow for interaction without disturbing functionality”
Species variety	4	“More potential for a greater variety of habitats, especially for nocturnal animals”
Separation/distance	3	“Habitats located higher above street level are better suited to this area”
Human activity	3	“I didn't include street planting because there is a café in the area”
Discretion	3	“As this is a quieter section I am less convinced obvious signals of habitat are required”
City-wide value	2	“A minimum of two types is required to maximise the benefits of integrating green infrastructure and wildlife “
Aesthetics/visibility	1	“It would be visually effective to employ green walls due to the large amounts of external open walls”
Close interaction	1	“More subtle interventions leaving awareness in the area to encounters with the wildlife itself”

humans (Table 6, Table 7). Several participants expressed opinion that habitat façade provided the more appropriate balance of street and building interior functionality for human use while preventing by-passer interference and disturbance with habitat.

These themes of suitability, functionality and separation carried on as influential in reasoning for habitat placement preferences but were related to the specific location context: habitat above awning level was considered appropriate in the mall area of Site A (Figure 13) in order to maintain pedestrian use, where as a planting strategy received more support in Site B (Figure 14) as it was seen to integrate in as part of existing street trees and planting despite concerns about proximity to vehicular traffic. The prevalence of these concepts across the question categories emphasises that despite appreciating the potential for benefits, participants prioritised human use and were extremely wary of the limitations and points of conflict within existing urban design.

Aesthetics and visual approach

Participants were given visual examples of insect hotels illustrating design aesthetics as ranging from 'natural' to 'man-made'. These examples were drawn from the design approaches spanning from wildscapes to highly artificial sculpture investigated in the literature review. Participants were asked to indicate their preference and explain their choice in a statement.

Table 8: Participant preference for visual style (Author, 2012)

Response	Percentage (%)
Which visual style appeals to you as most appropriate for designing habitat into public areas in Brisbane?	
More natural looking	25.00
In between	56.25
More man-made and sculptural	18.75

Table 9: Key thematic occurrences regarding stylistic preferences for artificial habitat (across 16 responses to open ended question) (Author, 2012)

Response theme	Count	Example
Integration with existing surrounds	5	"In an artificial environment something man made will blend better"
Positive aesthetics	5	"I think each style has its own attractiveness"
Habitat as 'nature'	4	"It seems more appropriate to have wildlife with natural, organic structures"
Juxtaposition or impact in surrounds	3	"I like the mix of human sculptures and buildings with nature"
Negative impact	3	"People might not utilise the area if there is a very natural/rustic feel"
Functionality	3	"It would also be important to consider how effective each style is at encouraging wildlife to take habitats"

The clear preference trend was for 'in-between' (Table 8); reasoning for this response closely followed contextual suitability and functional concerns as expressed in participant preferences over habitat placement. Most participants indicated that habitat should primarily be designed with the aim of "blending more with the surroundings" which suggested a strong influence related with opinions expressed elsewhere on 'discretion' (Table 7). One participant argued however that in an 'in between' aesthetic could allow for quite experimental pushing of boundaries between art, buildings, sculpture and natural materials e.g. living art that could adapt along with wildlife inhabitants.

In other responses the relationship between aesthetics, animal adaptation and management was associated with potential negatives (Table 9). Too natural an aesthetic was seen as inviting "unwanted attention and mess", confirming that negative perceptions around wildscapes as explored by Jorgenson and Licka maintain applicability within the Brisbane case study. Too man-made an aesthetic however, was perceived as unnatural for the wild-life occupants with concerns for its functionality as useful habitat.

> *If you make something too artificial it seems we are teaching the wildlife to adapt to us and not the other way around. But if you make it too natural, especially with species that make a lot of waste, it does make the city look messy and can cause a hygiene issue.*

Support for a flexible aesthetic fits well with participant preferences for design typology favouring green infrastructure and envelope habitat. As compositional elements of the urban landscape they present an established and legible context within which habitat can be incorporated through various degrees of modification; for example regardless of the detailed aesthetic intentions of habitat, a façade will still read as part of a building within the greater perceptible realm of the street as opposed to stand-alone structures such as Hwang's bat tower, the purpose of which may not be immediately perceived.

Biodiversity, wildlife valuation and ecological literacy

Participants indicated they generally had a positive attitude towards wildlife, with only one expressing intense dislike. Participants were not asked to make an explicit value statement regarding wildlife, however it was a recurrent theme across the open responses particularly when linked with concepts such as liveability of urban areas, and wildlife encounters as positive experiences. As such the study sample generally conforms to the cultural appreciation of wildlife inherent in established research of the Biophilia hypothesis (Hester, 2006; Kellert, Heerwagen and Mador, 2011; Miller, 2005).

While such demonstrated valuation and appreciation of wildlife is an important factor for biodiversity conservation as an identified legislative and heritage priority, participants as a whole rated greater concern for

biodiversity conservation and habitat loss outside of Brisbane than locally within Brisbane. This is in direct contrast to the theory developed by Dunn et al. (2006) proposing that support of external biodiversity conservation effort declines in hand with Miller's 'extinction of experience'.

Although measurable evidence of ecological knowledge decline was not within the scope of the study, when given a brief statement outlining the significance and extent of Brisbane's biodiversity situation, almost all participants indicated that they felt the average resident would be unaware of such information (Table 10). This, in line with nearly half the participants indicating they had no interest in increasing their knowledge of wildlife (Table 12), could be a significant contributive factor as to why biodiversity conservation within Brisbane was rated to a lesser extent. Additionally, participants demonstrated a low degree of environmental stewardship and participation in biodiversity conservation practices (Table 11).

This follows the precedent set by the N.S.W. Parks and Wildlife Services (N.S.W. National Parks and Wildlife Service, 2002) whereby individuals felt limited in their capacity to contribute to biodiversity measures. In this study however, it was further compounded by the perception that the built city environment of the case study area was severely constrained in providing suitable wildlife habitat conditions, a concern directly expressed by particpants:

> *Given the building density and lack of natural environment I find it hard to fathom how places such as these can be utilised as wildlife habitat.*

Despite this, there was still clear support amongst the participants for the use of artificial habitat within the CBD as a biodiversity conservation measure. As key preferences driving trend applicability were centred in the larger scale strategies of infrastructure and building façade approaches, this demonstrates that community based implementation for biodiversity strategy remains a key factor.

Using artificial habitat as an activism tactic for fostering community awareness and ecological literacy, was shown to have mixed levels of effectiveness in the study however. With regards to the identified Australian Government goal of main streaming biodiversity, the perceived likelihood of participants personally contributing to a biodiversity conservation initiative as a result of exposure to artificial habitats showed an increase of only 12.5% percent up from those who indicated they already contributed. Similarly, all but one of the participants who indicated that seeing artificial habitats would increase their interest in learning about native Brisbane wildlife had already expressed they had this interest in a previous question determining their perceived existing knowledge level (Table 12).

Table 10: Participant responses regarding biodiversity awareness in Brisbane (Author, 2012)

Response	**Percentage (%)**
Biodiversity conservation as environmental issue in Brisbane	
Extremely important	25.00
Quite important	43.75
Neither important nor unimportant	31.25
Not very important	0
Of no importance	0
Biodiversity conservation as environmental issue outside Brisbane	
Extremely important	37.50
Quite important	62.50
Neither important nor unimportant	0
Not very important	0
	0
Do you you think the average resident or tourist is aware of Brisbane's biodiversity heritage?	
Yes	12.50
No	87.50
Would you support using artificial habitat to encourage increased awareness of Brisbane wildlife biodiversity in public areas such as the CBD?	
Strongly support	18.75
Support	62.50
Neutral	6.25
Unsupportive	6.25
Strongly unsupportive	6.25

Table 11: Participant contribution to biodiversity conservation (Author, 2012)

Response	**Percentage (%)**
Existing rate of participation or contribution	
Does participate	18.75
Does not participate	81.25
Likeliness of participating or contributing in response to exposure to artificial habitats	
Yes	31.25
No	50.00
Not sure	18.75

Participant response indicated that exposure to artificial habitat would however encourage them to rethink such strategies to combat spatial conflicts with wildlife within buildings they occupied (Table 14), which suggests that artificial habitat could still play an educational role in wildlife management and ecological stewardship albeit in an incidental manner.

Table 12: Participant responses regarding wildlife knowledge (Author, 2012)

Response	Percentage (%)
Describe your existing knowledge and interest of local native wildlife	
Quite knowledgeable - maintains reasonable interest	0
Somewhat knowledgeable - interested in learning more	18.75
Average knowledge - interested in learning more	37.50
Average knowledge - not interested in learning more	43.75
Not very knowledgeable - interested in learning more	0
Not very knowledgeable - limited interest	0
Would seeing this artificial habitats around public areas in Brisbane make you more interested in learning about Brisbane's native wildlife and biodiversity?	
Yes	37.50
No	25.00
Not sure	37.50
Describe your existing ability to notice and observe wildlife in areas of natural habitat	
Very easy	50.00
Easy	25.00
Neutral	25.00
Difficult	0
Very difficult	0
Would seeing this artificial habitats around public areas in Brisbane make it easier to notice and observe wildlife?	
Yes	81.25
No	0
Not sure	18.75

Human-nature spatial relationship

The study as a whole demonstrated clear influence of the cultural human-nature paradigm thinking in participant perceptions. When asked to describe their perceptions on the degree of the human or wildlife occupation within their own neighbourhood, most participant responses indicated a clear demarcation between spaces seen as human and or wildlife occupied (Table 13). Parks and gardens were consistently identified as human and community orientated spaces regardless of presence or occupation by wildlife. Participants reported limited involvement in encouraging such wildlife occupation around buildings they occupied regularly (Table 14) but as no data was gathered regarding building typologies or contexts it was unknown whether barriers such as renting were prevalent. Despite this participants generally displayed interest in being around wildlife regularly, with limited reported spatial conflicts (Table 14) and healthy support for a shared habitat approach with wildlife (Table 13).

Table 13: Thematic frequnecy regarding perceptions of the degree of relationship between human and wildlife habitat across a neighbourhood (across 16 responses to open ended question) (Author, 2012)

Response theme	Count	Example
Human occupation	13	"I regard them as human properties in a high degree"
Animal occupation	6	"I am aware of the presence of wildlife such as possums, rats, birds.."
Shared habitat	6	"I think it's important that humans and animals share their natural habitat"
Animal adaptation	5	"Wildlife is always present – adapting to the changes we have made"
Human impact	4	"Wildlife driven out by incompatible human activities"
Protection / danger to wildlife	3	"The road is littered with road kill"
Positive interaction	2	"They allow a break from city life"
Negative interaction	2	"However those areas are overrun by dirty, gross and scary rats and possums"
Design intention	2	"Their design and construction typically addresses human aspects of living so I do not associate urban spaces with wildlife"
Development and welfare	1	"I believe this is important for the welfare of both ourselves and wildlife"
Liveability	1	"An important part of decreasing the concrete jungle effect"

Table 14: Participant responses regarding spatial proximities to wildlife (Author, 2012)

Response	Percentage (%)
Attitude towards being around wildlife in day to day circumstances	
Strongly like	43.75
Like	37.50
Neutral	12.50
Dislike	0
Strongly dislike	6.25
Have you specifically encouraged wildlife occupation around your residence?	
Yes	12.50
No	87.50
Have you experienced negative issues or conflict with wildlife in regularly occupied building?	
Frequently	6.25
Occasionally	37.50
Sometimes	6.25
Rarely	50.00
Never	0
Would seeing artificial habitats help you rethink ways of solving conflict or issues with wildlife around building you occupy?	
Yes	43.75
No	12.50
Not sure	43.75
Would seeing artificial habitats encourage you to improve natural habitat around building regularly occupied?	
Yes	43.75
No	25
Not sure	31.25

Perceptions of the inner city environment of the case study area followed these trends, being identified wholly as a 'human' area with concerns for human usage and functionality remaining the significant priority. With regards to a reconciliation ecology approach, participants did acknowledge the detrimental impact of human activity and current urban design strategies severely constrained opportunities for natural habitat as a biodiversity support measure. Adopting a 'tokenistic' approach for embedding habitat through methods such as self-contained artificial habitat was however discouraged; this position was strengthened by the strong participant preference on building habitat through multiple urban and street scale solutions.

Although such attempts at integrating artificial habitat via the built environment would need to submit to the high degree of control, limitations and aesthetic legibility associated with the architectural context, the participant focus on an approach that “blends in” indicates that artificial habitat could play an influential role in shifting the cultural placement of nature and wilderness. Rather than instigating a revolutionary or impact based approach, the study indicates that artificial habitat could allow for a more subtle, long term adjustment of the spatial demarcation of urban wildlife.

CONCLUSIONS

Summary of research and findings

This research was undertaken to explore the role architecturally orientated artificial habitat could play as an urban wildlife biodiversity conservation strategy within the framework of reconciliation ecology. As contemporary application of such habitat methodology is relatively undeveloped, the research aim was to establish a set of categories describing relevant design typologies and approaches. Four key classifications were derived, these being:

- Self-contained habitat
- Inserted habitat
- Envelope habitat
- Green infrastructure habitat

Furthermore as the literature review established that understanding of cultural and contextual perceptions regarding architecture and wildlife within the theoretical boundaries of the human-nature divide was critical to deriving an appropriate design strategy, the research methodology sought to provide a broad examination of such perceptions and opinions within a sample population. As such the specific intent of the research was to identify human occupant attitudes towards wildlife and preferences for applicability and approach of artificial habitat that could provide a distinct direction to target further design research and development as relevant to the Brisbane case study context. The dominant preferences with which to guide design development were identified as following:

- Target species strategy – avian fauna.
- Artificial habitat typology – a dual approach of green infrastructure and envelope habitat.
- Positioning of habitat – relative to the street or upper building levels as dependent on the habitat typology but removed from immediate pedestrian level.
- Aesthetic approach of habitat – intentionally discrete integration with the immediate context.

Within the research it was determined that prejudices and valuation processes associated with the human-nature theoretical divide remained distinctly apparent within the sample population, thus strategies for promoting reconciliation ecology and embedding habitat would need to focus either on a relatively subtle and conservative approach or conversely one that radically redressed habitat at an urban redevelopment level with demonstrable sustainable cultural and environmental infrastructure benefits.

While this supported the community and socially orientated ecology approach as advocated by Hester and Kwinter, it stood in some contrast to the highly conceptual and visual precedents promoting visibility and awareness as headed by figures such as Hwang and Haeg within the architectural community. As such, although there was strong support for the use of artificial habitat as a biodiversity conservation measure within the urban case study area, its usefulness as a tool for explicitly promoting biodiversity awareness and ecological literacy was limited.

Limitations to the research

This study was positioned as an initial evaluative exploration for which the methodology of quantitative and qualitative questioning was necessary in order to provide a broad thematic and contextual overview of perceptions and preferences within the available time frame for collection and analysis. This, compacted by the relatively small sample size and limited diversity of the participant population meant that emergent themes and data represents only a limited fraction of the rich cultural dimensions applicable to public realm in a sizeable city such as Brisbane. Furthermore, in order to address this study within the general scope of architecture and public opinion, a deliberate attempt was made to simplify ecological taxonomy and concepts and as such the research does provide in depth species data and requirements that could be significant to design requirements for biodiversity strategy for specific native species important to the case study area.

Application of research findings

In determining a clear language and set of directives for design methodology surrounding artificial habitat as an architectural component, the immediate benefit of this research is to provide a point of reference for design solutions relevant both to specific design practice within the Brisbane context and as a format for generalised design investigation elsewhere. Taking cue from the

relatively limited research available dealing specifically with this topic, the study provides a comprehensive overview of theoretical and conceptual topics relevant to development of this particular trend within the architectural field of knowledge. As an investigation point for biodiversity strategy, the research similarly contributes to discussion on the interdisciplinary role of design and contribution of architects within the fields of ecology and urban design.

Further research

Having determined a starting point for design research within the Brisbane context, this study presents the opportunity to begin developing specific habitat solutions and models as directed by the results for further testing. Presenting an actual hypothetical design within context will allow for more specific in-depth discussion of concerns and perceptions, particularly if using a larger qualitative study targeting a more diverse community demographic. Furthermore, while this research focused on embedding artificial habitat as a component of public realm within a city context, participant indication of support for adopting artificial habitat strategies within their own places of occupation suggest that a similar research process could be used to test preferences and perceptions for residential and suburban typologies.

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Figure 8
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Figure 9
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Figure 11
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Figure 12
Author. 2012. *Case study area – Albert St, Brisbane CBD*

Figure 13
Author. 2012. *Site A – Albert St adjacent to Queen St Mall*

Figure 14
Author. 2012. *Site B – Albert St between Charlotte & Mary St*

APPENDIX A – PRECEDENT ANALYSIS

SELF-CONTAINED HABITAT

Prosthetic Habitat for Lizards

http://www.waitakere.govt.nz/abtcit/ec/ecoinit/pdf/elevated-enclaves.pdf

Image	Project Overview	Design Intent and Aesthetics
	Results of a 3 year study on the Waitakere City Council building's green roof identifying significant insect diversity with potential to sustain lizard populations, this artificial habitat was developed to test the potential of green roofs to support relocation of endangered lizard species.	Designed by undergraduate Product Design students at Unitec New Zealand, this intervention provides a functional substitute for primary habitat requirements for skinks, while presenting an aesthetic appropriate to the green roof environment.

Target Species	*Location in Built Environment*	*Adjacency to Human Areas*	*Access*	*Materials*	*Dimensions*
Reptiles/Lizards – New Zealand copper skinks	Rooftop garden	Isolated from human areas	Layered panels with small openings to inner chambers	Raw concrete	D: 600mm W: 600mm H: 300mm

Elevator B

http://hivecity.wordpress.com/about/

Image	Project Overview	Design Intent and Aesthetics
	A collaborative project between the University of Buffalo's School of Architecture, the Department of Architecture's Ecological Practices Research Group, and Rigidized Metals; Elevator B was developed to relocate a colony of honeybees occupying a building at Silo City, an industrial site in Buffalo, NY.	Designed as an iconic gesture to the regeneration of the industrial area, the key aesthetic piece, the perforated stainless steel cladding acts primarily to protect the internal hive; itself a cypress timber box with a glass bottom through which the bees can be observed.

Target Species	*Location in Built Environment*	*Adjacency to Human Areas*	*Access*	*Materials*	*Dimensions*
Insects – Honeybees	Brownfield	Placed in 'open space' and open to human interaction	Hive accessed through perforated cladding and lowered for maintenance	Steel Frame: Perforated stainless steel cladding; Timber hive	D: 1800mm W: 1800mm H: 6700mm

Zeist Swift Nestbox

http://www.filcris.co.uk/products/product-details/swiftzeist

Image	Project Overview	Design Intent and Aesthetics
	A commercial product developed to be retrofitted to building facades establishing new habitats for Swifts in the urban environment and aiding in conservation.	Functionally designed in the style of the nest box successfully used in the Dutch city of Zeist, the entrance hole ensures only Swifts can use the box while a removable top panel allows for easy inspection and maintenance, and the white finish helps regulate internal temperatures.

Target Species	*Location in Built Environment*	*Adjacency to Human Areas*	*Access*	*Materials*	*Dimensions*
Birds – Swifts	Attached to building facade	Above human public space with limited accessibility	Small opening with operable top panel for maintenance	Recycled plastic	D: 210mm W: 420mm H: 220mm

Deller's Bat House Project

http://www.artsandecology.org.uk/magazine/features/caleb-klaces--making-the-bat-house2

Image	Project Overview	Design Intent and Aesthetics
	The winning entry of a competition to house bats in the WWT London Wetlands Centre nature reserve site, this artificial roost is a response to the gradual elimination of 'artificial' bat habitats through redevelopment of derelict buildings and diminished opportunity to nest in houses.	Simulation of natural habitat a norm in design of artificial habitats to meet functional requirement, design of this roost rather prioritises physical expression and aesthetic quality. The ornamental plywood exterior resulting from a process of layering images of nature, the bats live in a functional 'image of nature' rather than simulation of nature.

Target Species	*Location in Built Environment*	*Adjacency to Human Areas*	*Access*	*Materials*	*Dimensions*
Bats	Greenfield – Nature reserve	Placed in 'open space' with some human interaction	Rooftop and lower level bat access, restricted human access	Hempcrete; Timber roosts; Plywood facade	D: 2400mm W: 3000mm H: 4200mm

Bat Tower

http://www.antsoftheprairie.com/?page_id=203

Image	Project Overview	Design Intent and Aesthetics
	A prototype project exploring strategies to increase awareness of bats as a critical component of our ecosystem. Located next to a lake, boasting an abundance bat-attracting insects, the tower is intended to stand as a sculptural piece within the landscape.	Design intent to challenge the traditional notion of off-the-shelf bat houses, the tower rather than fading into the surroundings stands out as a prominent outdoor sculpture. Conceived as a vertical cave, the strong presence of the tower within the landscape contrasts the typical urban model of 'invisible' bat house installations.

Target Species	*Location in Built Environment*	*Adjacency to Human Areas*	*Access*	*Materials*	*Dimensions*
Bats	Greenfield – Parkland	Placed in 'open space' with some human interaction	Upper level bat access, restricted human access	Timber structure; Plywood upper cladding	D: 2400mm W: 2400mm H: 5000mm

INSERTED HABITAT

Brick Biotope

http://extra.wdka.nl/fabrikaat/team-1-moulding/

Image	Project Overview	Design Intent and Aesthetics
	Addressing the disappearance of the House Sparrow in the Netherlands and the need for nature to reclaim the built environment this series of bricks, developed to be inserted in traditional brick facades, create a natural and unobtrusive habitat for birds.	Intended as a substitute to the common red brick associated with traditional Ductch architecture, sand is utilised to mould the bricks creating a set of functional bird habitat typologies; water, nesting and feeding.

Target Species	*Location in Built Environment*	*Adjacency to Human Areas*	*Access*	*Materials*	*Dimensions*
Birds; Insects	Inserted into building facade	Directly adjacent and accessible	Small moulded openings	Plaster	D: 110mm W: 230mm H: 80mm

Bat Roost Brick

http://www.schwegler-natur.de

Image	Project Overview	Design Intent and Aesthetics
	A commercial solution to accommodating building inhabiting bats developed for new construction and retrofitting.	Focused on the functional issues of creating a habitable climate for bats and minimal maintenance, this roost is designed to be integrated as an invisible element in the building facade.

Target Species	*Location in Built Environment*	*Adjacency to Human Areas*	*Access*	*Materials*	*Dimensions*
Bats	Inserted into building facade	Directly adjacent but inaccessible	Small opening accessible to bats	Concrete; Internal wood panel	D: 125mm W: 200mm H: 470mm

Garden Building with Hosts and Nectar Plants for Cali's Butterflies

http://www.husos.info/EN_EJHNMC_text.html

Image	Project Overview	Design Intent and Aesthetics
	Commissioned as part of the building design for a small business, GBHNPCB is the first in a series of interventions to contribute to the environmental preservation in the city of Cali, Columbia, promoting a network of citizen gardeners that could take care of the local ecosystem.	Local butterflies an effective bioindicator of environmental quality and biodiversity, integrated wall and hanging pods are planted with host and nectar plants to create a garden dispersed throughout the building.

Target Species	*Location in Built Environment*	*Adjacency to Human Areas*	*Access*	*Materials*	*Dimensions*
Butterflies	Inserted and attached to building facade and adjacent garden	Directly adjacent and accessible	Opening in pod – generally containing planting	Concrete	D: 400mm W: 1200mm H: 900mm

Ottoman Bird House

http://www.efgan.net/index.asp?PageID=35

Image	Project Overview	Design Intent and Aesthetics
	A traditional Ottoman version of the common bird house, dating from the 16th century, built to encourage the peaceful sounds of birds exemplified is a recognition of the positive contribution wildlife makes in urban settings.	Maintaining a consistent style with the greater facade, though at a miniature scale, consideration is not given to mimicking a natural habitat but rather creating a functional space representative of the building as a whole.

Target Species	*Location in Built Environment*	*Adjacency to Human Areas*	*Access*	*Materials*	*Dimensions*
Birds	Inserted into building facade	Directly adjacent but inaccessible	Small openings to allow bird access only	Stone	D: 400mm W: 1800mm H: 1200mm

WWF Building Bat Nests

http://www.rau.eu/en/2009/11/wnf-hoofdkantoor/#more-1237

Image	Project Overview	Design Intent and Aesthetics
	Renovation/reconstruction of a 1950 agricultural laboratory building for the World Wildlife Funds (WWF) headquaters, the organisations identity is translated into the building with the architecture integrating the building into it surrounds. At a key intersection of the building bats are access through the facade to a section of the basement as an extension of their habitat.	Aesthetic quality of the building was not been compromised in pursuit of the WWF environmental goals, access for bats is comprised of a number of openings seamlessly integrated into the building's cladding.

Target Species	*Location in Built Environment*	*Adjacency to Human Areas*	*Access*	*Materials*	*Dimensions*
Bats	Integrated into building facade	Directly adjacent but inaccessible	Small openings in building facade	Metal cladding; timber roosts	-

ENVELOPE HABITAT

Put a Bird on it

http://cargocollective.com/tlamphier/filter/GSAPP-Fall-2011/Put-a-Bird-on-it

Image	Project Overview	Design Intent and Aesthetics
	Rejecting contemporary notions of pigeons as pests within the urban environment this project seeks to act as a means to re-establish habitat on building facades, enhancing the dialogue between building/people and wildlife.	A modular cladding system aimed at typical curtain glazed buildings, developed is a mix of functional design, offering shading to the building occupants, and protected ledges and cavities for pigeons while maintaining a high level of visual appeal and aesthetic quality.

Target Species	*Location in Built Environment*	*Adjacency to Human Areas*	*Access*	*Materials*	*Dimensions*
Birds – Pigeons	Building facade	Above human public space with limited accessibility	Open ledges and cavities	Folded perforated steel	-

Pest Wall

http://www.antsoftheprairie.com/?page_id=733

Image	Project Overview	Design Intent and Aesthetics
	Exploring various strategies for providing habitation for bats, this project begins to reconsider purpose of the facade from mere protection from the outdoors to an inhabitable membrane for propagation of living organisms.	Increasing visibility of bats considered as 'pests' is intend to challenge common notion of them as undesirable occupants of the urban realm, intensifying public awareness of animals and developing understanding of their critical role in our ecosystem.

Target Species	*Location in Built Environment*	*Adjacency to Human Areas*	*Access*	*Materials*	*Dimensions*
Bats	Building facade	Above human public space with limited accessibility	Open ledges and cavities	Timber	-

Animal Wall

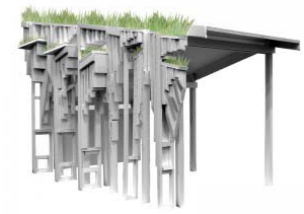
http://www.dezeen.com/2009/08/28/animal-wall-by-gitta-gschwendtner/

Image	Project Overview	Design Intent and Aesthetics
	Part of a 50 metre long wall separating a new residential development from adjacent parkland, Animal wall is an artwork attempting to assist wildlife in the area and encourage further habitation; matching the 1,000 new residences with 1,000 nest boxes accommodating birds and bats.	Though consultation made with an ecologist to developed four nesting boxes typologies ensuring function of suitable habitat for the targeted species, the strongly formal aesthetic applied to the wall defines it as an architectural piece rather than something more 'natural'.

Target Species	*Location in Built Environment*	*Adjacency to Human Areas*	*Access*	*Materials*	*Dimensions*
Birds and Bats	Boundary wall to residential developent	Directly adjacent but inaccessible	Small openings to allow bird and bat access	Woodcrete	-

Habitat Wall

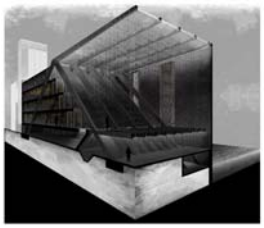
http://www.antsoftheprairie.com/?p=1029

Image	Project Overview	Design Intent and Aesthetics
	A conceptual project, this facade system is aimed at producing a series of nesting and feeding opportunities along the building face developing a more holistic facade ecosystem.	Functionally considered in creating roosts and nesting opportunities in the upper section as the structure extends down to ground level it begins to open and give way to human interaction, aesthetic quality is predominately derived through its functional elements, becoming neither a natural nor artificial object, but in-between.

Target Species	*Location in Built Environment*	*Adjacency to Human Areas*	*Access*	*Materials*	*Dimensions*
Bats; Birds; Insects	Building facade	Above human public space with limited accessibility	Small openings; ledges;	Concrete; timber	-

Nottingham Apiary

http://www.animalarchitecture.org/interview-nottingham-apiary-team/

Image	Project Overview	Design Intent and Aesthetics
	Colony collapse disorder becoming a major concern in bee populations, this project seeks to revive local bee populations in a way that is non-threatening to humans through transforming an existing structure into the framework for a bee habitat.	Additions acting as the entrance to the building creating a human interface, bees are intended to be introduced to the public in a non-threatening context, this strategy thus helping to building a human understanding of and relationship with bees.

Target Species	*Location in Built Environment*	*Adjacency to Human Areas*	*Access*	*Materials*	*Dimensions*
Bees	Building	Part of 'constucted environment'; some accessibility	Permeable facade	Concrete; Steel	-

GREEN INFRASTRUCTURE

Cancer City

http://thegoldbrain.blogspot.com.au/2010/08/cancer-city.html

Image	*Project Overview*	*Design Intent and Aesthetics*
	An artificial refuge, this project was commissioned to help support a colony of crayfish in a lake within a private estate. Though establishing a more suitable habitat, problematic emigration of crayfish to neighbouring properties was stopped.	Made of a lightweight concrete product, the refuge creates a new landscape within the as a substitute for a lack of existing stones and hiding places. A functional piece the lightweight concrete allows it to be lifted in to place by hand, and integrated lighting and access lids aid in attracting and catching crayfish.

Target Species	*Location in Built Environment*	*Adjacency to Human Areas*	*Access*	*Materials*	*Dimensions*
Crayfish	Greenfield – lake	Placed in 'open space' and open to human interaction	Undulating surface creates cabins for crayfish while 'lids' allow internal access	Lightweight perforated concrete	-

Tarregona Cultural Complex

http://www.v-ter.com/green_wall_babylon.htm

Image	*Project Overview*	*Design Intent and Aesthetics*
	A new cultural complex in Tarragona, Spain, reused industrial buildings are clad with a suspended green wall, incorporating a range of wildlife habitat to act as an extension of the rejuvenated parkland surrounds.	The modular system of green wall suspended in front of existing structure, is utilised aesthetically to soften the harsh exterior of the reused industrial building while functionally serves as a greywater filter and incorporates honey plants, nutrients and bird nests throughout as an extension of surrounding parkland.

Target Species	*Location in Built Environment*	*Adjacency to Human Areas*	*Access*	*Materials*	*Dimensions*
Birds; Bees	Building facade	Directly adjacent but inaccessible	Flight; nesting opportunities and honey plants	Steel frame; modular substrate	Module – W:500mm H:1000mm Facade – 2500m^2

Compton Road Animal Overpass

http://www.brisbane.qld.gov.au/documents/environment/fauna-friendly_crossings.pdf

Image	*Project Overview*	*Design Intent and Aesthetics*
	A basic piece of civil infrastructure implemented to provide wildlife access across a busy highway bisecting national park reserve.	A piece of functional infrastructure, concern is given only at access and engineering levels aiming simply to provide a direct land based access across a busy road.

Target Species	*Location in Built Environment*	*Adjacency to Human Areas*	*Access*	*Materials*	*Dimensions*
All in immediate area	Parkland/Roadway	Crossing over human space	Direct path of movement	Concrete	-

Southbank Planted Shade Arbour

http://www.visitsouthbank.com.au/attractions/the-arbour

Image	*Project Overview*	*Design Intent and Aesthetics*
	A kilometre long civic structure, functioning as a pedestrian walkway through the South Bank parkland, a canopy of bougainvillea shrouds the path offering a cool shaded human environment and new habitat to local wildlife.	Designed as a sculptural piece, composed of 443 steel tendrils upon which the canopy of bougainvillea grows, intent is to engage human activity through the park creating engaging experiences with nature.

Target Species	*Location in Built Environment*	*Adjacency to Human Areas*	*Access*	*Materials*	*Dimensions*
Birds; Insects; Reptiles; Mammals	Greenfield – public parkland	Part of human area	Direct path of movement	Steel planting trellis	-

New York High line

http://www.thehighline.org/design/high-line-design

Image	*Project Overview*	*Design Intent and Aesthetics*
	A public park built on an historic freight rail line elevated above the streets on Manhattan, this project substantiates a critical mass of new habitat within an urban setting offering a diverse set opportunities for human/wildlife interaction.	Established as a way to preserve the historic structure and reopen it to public use, this project sets about creating elongated parkland landscapes directed toward human use, the resulting outcome however also comes to act as a refuge offering new opportunities for wildlife above the busy streets below.

Target Species	*Location in Built Environment*	*Adjacency to Human Areas*	*Access*	*Materials*	*Dimensions*
Birds; Insects; Reptiles; Mammals	Pathway/parkland above city streets	Part of human area	Direct path of movement	Conctrete; steel; timber; glass	-

APPENDIX B - QUESTIONNAIRE

Queensland University of Technology
Brisbane Australia

PARTICIPANT INFORMATION FOR QUT RESEARCH PROJECT
– Questionnaire –

Master of Architecture Student Research Project

QUT Ethics Approval Number 1000000691

RESEARCH TEAM

Principal Researcher:	Megan Stokes, Postgraduate Student – School of Design, Creative Industries Faculty
Associate Researcher:	Dr Mirko Guaralda, Post-Graduate Subject Area Coordinator – Architecture School of Design, Creative Industries Faculty – Queensland University of Technology (QUT)

DESCRIPTION

This project is being undertaken as part of the Master of Architecture for Megan Stokes, Postgraduate Student.

The purpose of this project is to investigate public opinions concerning design of artificial wildlife habitat in public areas in Brisbane as part of promoting biodiversity awareness.

You are invited to participate in this project as a Brisbane resident with assumed knowledge of wildlife in the CBD.

PARTICIPATION

Your participation in this project is entirely voluntary. If you do agree to participate you can withdraw from the project before submission of the anonymous questionnaire without comment or penalty; after submission of the anonymous questionnaire will not be possible to withdrawn. Your decision to participate or not participate will in no way impact upon your current or future relationship with QUT.

Participation will involve completing a 28 item anonymous questionnaire of single choice or short answer questions that will take approximately 30 minutes of your time. Questions will include 1) Which of the following best describes your knowledge and interest of local wildlife? 2) Would you support using artificial habitat to encouraged increased awareness of wildlife biodiversity in public areas of Brisbane? 3) Which visual style appeals most to you as appropriate for designing habitat into public areas around Brisbane? Etc.

If you agree to participate you do not have to complete any question(s) that you are uncomfortable answering.

EXPECTED BENEFITS

It is expected that this project will not benefit you directly. However, it may benefit the general community. You may request a copy of the research findings to be sent to you.

RISKS

There are no risks beyond normal day-to-day living associated with your participation in this project.

PRIVACY AND CONFIDENTIALITY

All comments and responses are anonymous and will be treated confidentially.
Any data collected as part of this project will be stored securely as per QUT's Management of research data policy.
Please note that non-identifiable data collected in this project may be used as comparative data in future projects.

CONSENT TO PARTICIPATE

The return of the completed questionnaire is accepted as an indication of your consent to participate in this project.

QUESTIONS / FURTHER INFORMATION ABOUT THE PROJECT

If have any questions or require any further information please contact one of the research team members below.

Megan Stokes Post Graduate Student	Dr Mirko Guaralda Post-Graduate Subject Area Coordinator – Architecture
School of Design – Creative Industries Faculty	
0423237024 m2.stokes@connect.qut.edu.au	(07) 3138 2464 m.guaralda@qut.edu.au

CONCERNS / COMPLAINTS REGARDING THE CONDUCT OF THE PROJECT

QUT is committed to research integrity and the ethical conduct of research projects. However, if you do have any concerns or complaints about the ethical conduct of the project you may contact the QUT Research Ethics Unit on +61 (0)7 3138 5123 or email ethicscontact@qut.edu.au. The QUT Research Ethics Unit is not connected with the research project and can facilitate a resolution to your concern in an impartial manner.

Thank you for helping with this research project. Please keep this sheet for your information.

PLEASE OPEN IN ADOBE READER TO FILL OUT YOUR ANSWERS.
WHEN YOU ARE FINISHED SAVE THE CHANGES TO PDF AND
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TO: m3.stokes@gmail.com
Thank you.

SECTION 01 BACKGROUND INFORMATION

Please select one answer per question unless indicated.

Q01 **What is your gender?**

- ☐ Male
- ☐ Female

Q02 **What is your age?**

- ☐ 18 and under
- ☐ 19 - 24
- ☐ 25 - 44
- ☐ 45 - 64
- ☐ 65 and upwards

Q03 **What is your highest level of education?**

- ☐ Secondary Education (Year 10 or 12)
- ☐ Trade Course/Certificate/Diploma
- ☐ University Degree
- ☐ Post Graduate Degree

Q04 **How often do you come into the Brisbane City CBD?**

- ☐ Once a month or less
- ☐ Once a fortnight
- ☐ Once a week
- ☐ 2 - 4 times a week
- ☐ 5 times or more a week (e.g. near daily basis)

Q05 **For what reason(s) do you come into the Brisbane City CBD?**

- ☐ Place of residence
- ☐ Place of work or work duties
- ☐ Education
- ☐ Social activities
- ☐ Leisure or recreation
- ☐ Retail

SECTION 02 LIVING WITH WILDLIFE

Please select one answer per question unless indicated.

Q06 **Which of the following best describes your attitude towards wildlife in general?**

- ☐ Strongly like
- ☐ Like
- ☐ Neutral
- ☐ Dislike
- ☐ Strongly dislike

Q07 **Which of the following best describes your knowledge and interest of local native wildlife?**

Example, your knowledge of native birds:
Knowledgable "I can identify particular species such as the migratory Flinders Cuckoo."
Average knowledge "I can identify several general or popular species around such as Magpie, Ibis, Brush Turkey"
Not very knowledgable "I can't really identify any more than a few species, they're just birds."

- ☐ I am quite knowledgable and have a reasonable interest.
- ☐ I somewhat knowledgable and am interested in learning more.
- ☐ I have an average knowledge and am interested in learning more.
- ☐ I have an average knowlege but am not interested in learning more.
- ☐ I am not very knowledgable but am interested to learn more.
- ☐ I am not very knowledgable and have no interest.

Q08 **When you are around trees, parks, gardens or areas of vegetation in Brisbane how would you describe your ability to notice and observe wildlife?**
(You do not have to be able to identify them.)

- ☐ Very easy - I can find many different types such as lizards, koalas, insects etc
- ☐ Easy - I can usually pick out more visible ones such as birds.
- ☐ Neutral - I might notice something if it catches my eye.
- ☐ Difficult - I can sometimes pick out more visible ones such as birds.
- ☐ Very difficult - I find it hard to pick them out in vegetated areas.

Q10 **Think about a neighbourhood you occupy regularly: its buildings, gardens, the streets, parks... To what degree do you think of them as human properties and places for communities *and/or* as places for wildlife habitat and part of the natural world?**
Please give a brief description of your views in the box below.

Q09 **Which of the following best describes your attitude towards being around wildlife in your day-to-day life?** Examples: around your house, in the street, near your workplace, around shops etc...

- ☐ Strongly like - I enjoy seeing and/or interacting with wildlife.
- ☐ Like - I feel comfortable seeing wildlife nearby.
- ☐ Neutral - Unless it is threatening, the presence of wildlife is of no concern.
- ☐ Dislike - I am a little uncomfortable if wildlife is nearby.
- ☐ Strongly dislike - I avoid or leave situations where wildlife are present.

Q11 **Have you experienced any negative issues between yourself and wildlife in a place you occupy regularly such as your residence or workplace?**
Examples: possums in roof, birds flying into windows, spiders inside etc...

- ☐ Frequently
- ☐ Occasionally
- ☐ Sometimes
- ☐ Rarely
- ☐ Never
- ☐ Not sure / I don't pay attention

Q12 **Have you specifically encouraged native wildlife occupation around your residence through such methods as installing nest boxes, growing native forage plants, etc?**

- ☐ Yes
- ☐ No

Q13 **How would you rate loss of natural habitat and declining native biodiversity as an environmental issue to be addressed *in* Brisbane?**

- ☐ Extremely important.
- ☐ Quite important.
- ☐ Neither important nor unimportant.
- ☐ Not very important.
- ☐ Of no importance.

Q14 **How would you rate loss of natural habitat and declining native biodiversity as an environmental issue to be addressed *outside* of Brisbane?**

- ☐ Extremely important.
- ☐ Quite important.
- ☐ Neither important nor unimportant.
- ☐ Not very important.
- ☐ Of no importance.

Q15 **Do you personally participate in or contribute to initiatives that support biodiversity conservation?** **Examples: wildlife groups, landcare groups, council programs etc.**

- ☐ Yes.
- ☐ No.

SECTION 03 WILDLIFE IN THE BRISBANE CBD

Please select one answer per question unless indicated.

This part of the questionnaire is assessing your views on Albert Street in Brisbane City CBD, outlined red in the aerial view below.

Q16 **Have you specifically noticed wildlife around when you have been in this area of Brisbane CBD?**

- ☐ Frequently.
- ☐ Occasionally.
- ☐ Sometimes.
- ☐ Rarely.
- ☐ Never.
- ☐ Not sure / I don't pay attention.

If so, could you give a general indication of:

Where around Albert Street.
What sorts of species.
The type of interaction (and if it was positive or negative).

Examples: "Sitting near the ducks in the Botanic Gardens at lunchtime"
"Avoiding a possum scrounging in a bin late at night on Queen St Mall"
"Watching birds from my office window near Charlotte Street when I'm bored"

Please give a brief description in the box below.

Consider the following information:
Brisbane lies in between two globally recognised "biodiversity hotspots" and has the greatest wildlife and plant species diversity of any capital city in Australia; Brisbane alone is home to nearly half of all Australia's bird species for example, and some 500 species of vertebrate animals.

Q17 **Do you think the average Brisbane resident or tourist is aware of Brisbane's biodiversity heritage?**

- ☐ Yes.
- ☐ No.

As a popular public area frequented by residents and tourists, do you feel the CBD gives visitors any indication of Brisbane's status as the most biologically rich city in Australia?

- ☐ Yes.
- ☐ No.

Artificial habitat refers to areas occupied by wildlife that have been modified by humans, such as cities. Designing the built environment specifically to provide artificial habitat is a method of accomodating wildlife and increasing biodiversity in cities while maintaining human use of the landscape. This also allows for visual communication of the presence of wildlife.

Q18 **Would you support using artificial habitat to encourage increased awareness of wildlife biodiversity in public areas of Brisbane such as the CBD?**

- ☐ Strongly support.
- ☐ Support.
- ☐ Neutral.
- ☐ Unsupportive.
- ☐ Strongly unsupportive.

Artificial habitat can specifically be designed to look 'artificial' as part of the built environment, it may be also designed with a more natural aesthetic or something in between. Below are three examples of an 'insect hotel' illustrating the range in different visual design styles for incorporating artificial wildlife habitat into the urban built environment.



Q19 **Which visual style appeals most to you as appropriate for designing habitat into public areas in Brisbane?** *Please give a brief indication why in the box.*

- ☐ More natural looking
- ☐ In-between
- ☐ More man-made and sculptural

Below are examples of four construction types for placing artificial wildlife habitat into the urban built environment.

Type A: **Self-Contained Habitat**

These are either free-standing constructions or boxes or vessels mounted on an external wall. These can be various sizes and are often intended to be permanently occupied.


Reptile Shelter Slab


Bee Hive


Bird Boxes


Bat House

Type B: **Inserted Habitat**

Small sections of habitat that are inserted in a wall or building. They can suit the building or stand out.


Bird and Insect Brick


Bat Roost Brick


Butterfly Pods


Bird Roost

Type C: **Envelope Habitat**

Where the overall design of a building surface forms parts of habitat or encourages wildlife to pass through.


Bird Roost Facade


Bat Roost Facade


Bird Roost Fence


Mixed species Facade

Type D: **Green Infrastructure**

This might combine habitat with parts of urban or building design that provide other services, such as storm water channels, shading structures, planting for air quality etc.


Shelter in Creek

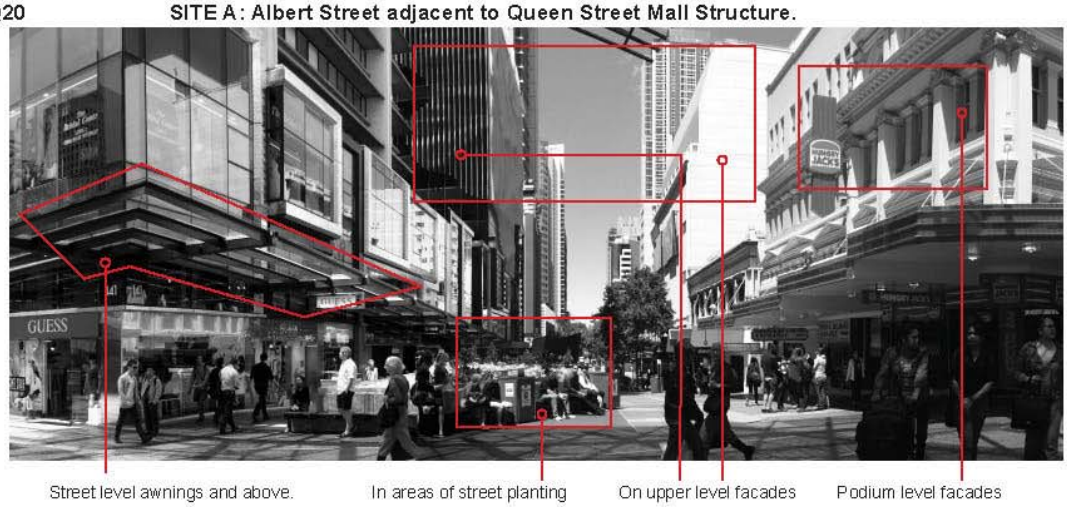

Grey water green wall.


Animal Overpass


Planted Shade Arbour

The next question is hypothetical and will assess your views on preferred placement for incorporating artificial habitat into Site A, representing a major pedestrian occupied area on Albert Street with lots of exposure. You may selcet more than one answer for each.

Q20 **SITE A: Albert Street adjacent to Queen Street Mall Structure.**



Which species types would be your preference for this area?

- ☐ Birds
- ☐ Small mammals
- ☐ Insects
- ☐ Bats
- ☐ Reptiles

Which artificial habitat types appeal most to you as appropriate for design into this site?

- ☐ Type A - Self contained habitat
- ☐ Type B - Inserted habitat
- ☐ Type C - Envelope habitat
- ☐ Type D - Green infrastructure

Which areas of placement appeals most to you as appropriate for design into this site?

- ☐ Street level awnings and above.
- ☐ In areas of street planting.
- ☐ Upper level facades.
- ☐ Podium level facades.

Could you give a brief explanation of your reasoning for your choices?

The next question is hypothetical and will assess your views on preferred placement for incorporating artificial habitat into Site B, representing a tyical city street with varied public pedestrian levels and varied exposure. You may select more than one answer for each.

Q21 **SITE B: Albert Street between Charlotte and Mary Street.**

In areas of street planting. On upper level facades. Podium levels. Street level awnings and above.

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Which species types would be your preference for this area?

- ☐ Birds
- ☐ Small mammals
- ☐ Insects
- ☐ Bats
- ☐ Reptiles

Which artificial habitat types appeal most to you as appropriate for design into this site?

- ☐ Type A - Self contained habitat
- ☐ Type B - Inserted habitat
- ☐ Type C - Envelope habitat
- ☐ Type D - Green infrastructure

Which areas of placement appeals most to you as appropriate for design into this site?

- ☐ Street level awnings and above.
- ☐ In areas of street planting.
- ☐ Upper level facades.
- ☐ Podium level facades.

Could you give a brief explanation of your reasoning for your choices?

SECTION 05 RESPONSE TO ARTIFICIAL HABITATS *Please select one answer per question unless indicated.*

Q22 **Would seeing such types of artificial habitat around popular public places such as around the CBD make you more aware of Brisbane's biodiversity, or make it easier to notice and observe a wider variety of types of Brisbane's native wildlife?**

- ☐ Yes
- ☐ No
- ☐ Not sure

Q23 **Would seeing such types of artificial habitat around public places make you more interested in learning about Brisbane's native wildlife and different biodiversity?**

- ☐ Yes
- ☐ No
- ☐ Not sure

Q24 **Would seeing the presence of more wildlife around around public places make being in Brisbane's CBD a more engaging experience?**

- ☐ Yes
- ☐ No
- ☐ Not sure

Q25 **Would seeing these types of artificial habitat in public places around Brisbane lead you to consider how you could improve natural wildlife habitat around your own residence or a building you regularly occupy?**

- ☐ Yes
- ☐ No
- ☐ Not sure

Q26 **Would seeing these types of artificial habitat in popular public places around Brisbane lead you to consider how you could use artificial habitats to rethink ways of solving conflicts or issues with wildlife around your own residence or a building you occupy?**

- ☐ Yes
- ☐ No
- ☐ Not sure

Q27 **If you often saw these types of artificial habitats in popular public places, would they make you more likely to personally participate in or contribute to initiatives that support biodiversity conservation if you don't already?**
Examples: wildlife groups, landcare groups, council programs etc.

- ☐ Yes
- ☐ No
- ☐ Not sure

Q28 **Any further comments or observations?**